



115

Attorney's Docket No.: 042390P8695

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application for:

Borys S. Senyk, et al.

Serial No.: 09/607,871

Filed: June 30, 2000

For: A METHOD AND APPARATUS FOR
COOLING A COMPUTER

Examiner: McKinnon, Terrell L.

Art Group: 3743

RECEIVED

AUG 14 2002

TECHNOLOGY CENTER R3700

DECLARATION PURSUANT TO 37 C.F.R. § 1.131

Honorable Commissioner
for Patents
Washington, D.C. 20231

Dear Sir:

I, Borys Senyk, hereby declare that:

1. I am a citizen of the United States of America.
2. I currently reside at 1020 Polk Lane, San Jose, California 95117-95124
3. I am currently an employee of Intel Corporation, Santa Clara, California.
4. I have been employed by Intel from 1995 to present.
5. My current title at Intel is Senior Researcher. Staff Engineer
6. I am a co-inventor of the above-identified patent application.
7. Intel is the assignee of the above-identified patent application.
8. I have reviewed U.S. Patent No. 6,196,003 issued to Macias, et al.

("Macias") which was filed on November 4, 1999. The Examiner has cited Macias against the claims of the above-identified application.

9. The invention disclosed and claimed in the above-identified patent application was conceived in the United States at least as early as November 4, 1999, as

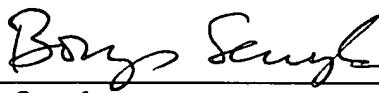
evidenced by the "Intel Invention Disclosure" and "Abstract of the Invention", copies of which are being filed herewith. These documents were reduced to writing internally within Intel Corporation at least as early as November 4, 1999. These documents demonstrate a conception and reduction to practice of the claimed invention of the instant application and were prepared under my direction and based on my own original work. Between reduction to writing and the constructive reduction to practice by filing of the above-identified patent application on June 30, 2000, I directed simulations in a diligent effort to reduce the claimed invention to practice. Therefore, the conception and diligence toward reduction to practice of the invention disclosed and claimed in the above-identified patent application occurred prior to the filing date of Macias.

10. The documents provided herewith are designated "Confidential" and "Intel Confidential". It is Intel Corporation's practice to maintain in secrecy all documents designated "Intel Confidential". I believe that the documents provided herewith have at all times prior to the filing date of the above-identified patent application been maintained in a confidential manner.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issued thereon.

Respectfully submitted,

Dated: 1 July, 2002



Borys Senyk

Full Name: Borys Senyk

Citizenship: United States of America

Residence: 1020 Polk Lane 4139 MYS71c DR
San Jose, California 95117

042390P8695

CONFIDENTIAL

13786

INTEL INVENTION DISCLOSURE
ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

DATE: 3 Feb 2000

1747G/174PG
COMM.

It is important to provide accurate and detailed information on this form. The information will be used to evaluate your invention for possible filing as a patent application. When completed and signed, please return this form to the Legal Department at JF3-147. If you have any questions, please call 264-0444.

Inventor: Senyk _____ Borys _____ S _____
Last Name First Name Middle Initial

Citizenship: USA Contractor: YES _____ NO

Inventor: Moresco _____ Larry _____ Middle Initial
Last Name First Name

Contractor: YES _____ NO

Title of Invention: Fluid Cooled Notebook Computer

RECEIVED

What technology/product/process (code name) does it relate to (be specific if you can):
Notebook computer cooling technology

FEB 04 2000

Include several key words to describe the technology area of the invention in addition to # 3 above:
Refrigeration, chilled fluid cooling

PATENT DATABASE GROUP
INTEL LEGAL TEAM

Abstract of the Invention

Title: Fluid Cooled Notebook Computer

Purpose: The purpose of this invention is to significantly improve/increase the thermal cooling capability of a notebook computer and thus to significantly increase the computing performance.

Thermal cooling capability is directly proportional to the mass flow rate of the cooling medium transporting heat energy from the heat generation source to the heat rejection point, such as a remote heat exchanger (RHE). A closed loop fluid system with a pump can provide a much higher mass flow rate than a passive heat pipe and thus can remove more heat than a passive heat pipe, particularly if the fluid is chilled. This system would be contained within the notebook computer or any other small form-factor computer.

A secondary cooling loop system external to the laptop providing chilled fluid at a higher fluid flow can be connected to the self contained laptop cooling loop through a quick-disconnect coupling. A liquid to air heat exchange system with its own fluid pump external to the laptop provides enhanced cooling and as a consequence would enable much higher processor performance. The notebook computer can be operated at this high performance level whenever such an external cooling source is available. Examples where this external cooling system could reside include a docking station or a AC battery charger brick.

A liquid cooling loop within the laptop makes it easy to move heat to the notebook lid area, where a large surface area could be made available for heat rejection. Given a large surface area, a relatively small velocity is required to reject heat into the ambient air. Low air velocity means low noise. Low noise heat rejection would also be valuable for small form-factor desktop computers.

Advantages:

- Significantly enhanced cooling capability
- Cooling capability is easily augmented by connecting to an external source of chilled fluid
- Heat is more easily moved from the notebook base to the lid, where a large surface area is available to reject the heat into the ambient air with low noise levels
- Water as the cooling fluid is safe in case of leakage due to physical damage

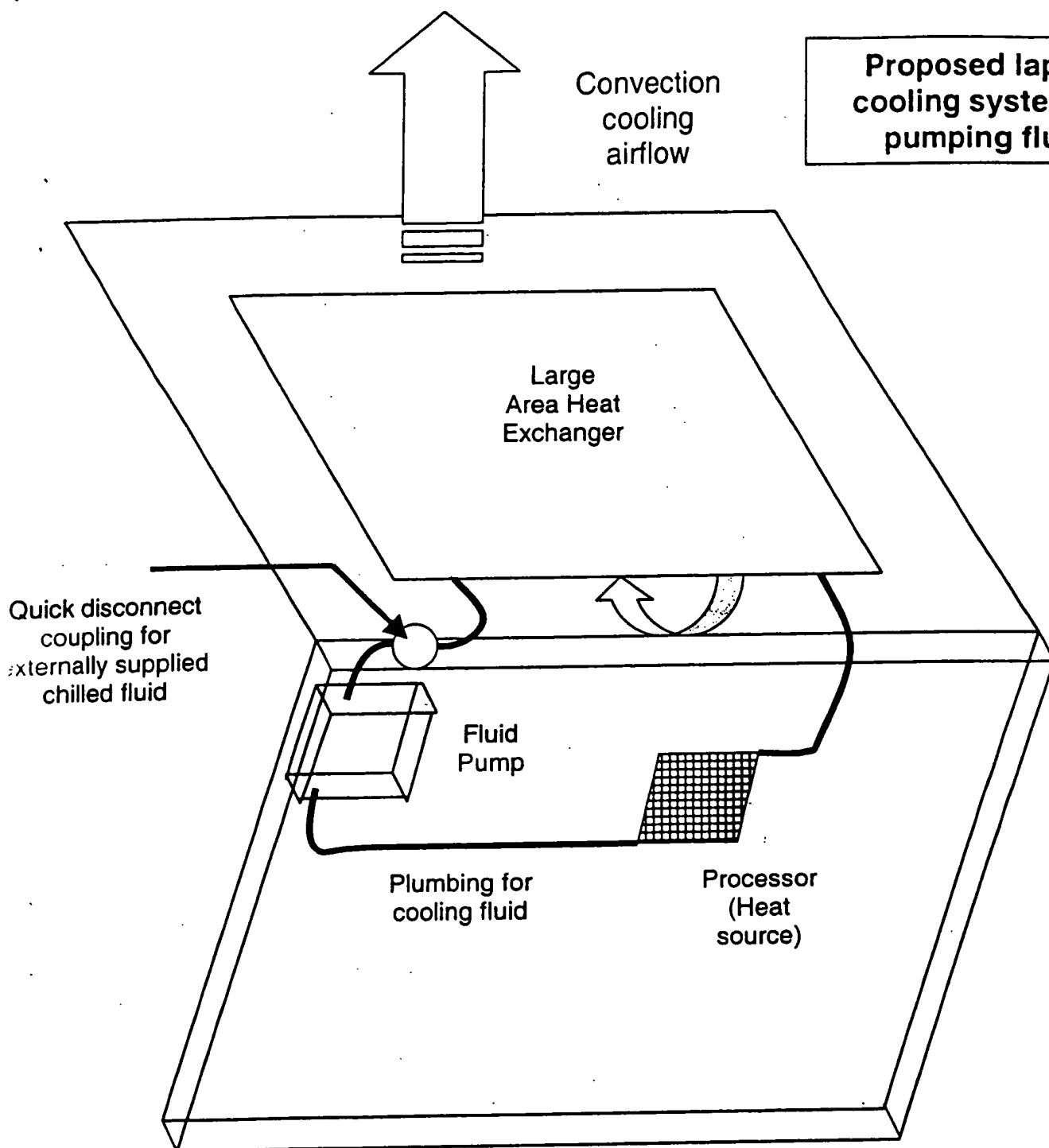
Key Elements:

1. A closed loop system consisting of heat exchangers at the heat source (conduction to liquid heat exchanger) and rejection (liquid to air heat exchanger, either forced or natural convection air) points. Plumbing is required to contain the cooling fluid and connect the two heat exchangers and a pump to re-circulate the cooling fluid. The cooling fluid is typically most effective as a cooling and transfer medium is water treated to prevent fouling of the pumping/plumbing system.
2. A quick-disconnect coupling connector for easy connection to an external source of high volume chilled cooling fluid, such as AC power brick or port replicator/ docking station. This disconnect structure can either augment the existing cooling loop or in the process of connecting to the existing loop, disable that loop and assume the complete cooling process. Any number of methods can be used to chill the fluid, including conventional refrigeration, heat exchangers, Peltier effect devices, etc.
3. A low audible noise liquid to air heat exchanger in the notebook lid, taking advantage of a large surface area for heat rejection into ambient air. This can be accomplished by creating natural convection air fins or a low flow forced convection fan driven liquid to air cooling fin system.
4. For maximum cooling efficiency the air in the liquid to air convection heat exchanger would flow counter current to the liquid to be cooled. This means that one would pump the heated fluid to the top of the heat exchange surface in the lid and traverse the fluid plumbing back and forth across the lid heat exchanger making positive thermal contact between the heat exchanger and the fluid plumbing. This would continue until the plumbing reached the bottom of the heat exchanger. Thus the coolest air entering the heat exchanger surfaces at the bottom of the lid exchanger would be exposed to the coolest liquid. Likewise, the air which is most heated as it passes through the heat exchanger would be exposed to the hottest fluid in the system at the top of the lid heat exchanger. The net effect is a counter current air to liquid heat exchange system which as a heat transfer process is known to have the highest cooling efficiency or greatest heat rejection capability in either natural or forced air convection cooling modes.

Value to Intel: Enhanced thermal cooling will enable the use of higher performance Intel processors in notebook computers, bringing more value to the user and higher revenue to Intel.

Prior Art: Fluid cooling is not new, but it's application in a laptop computer is novel. This invention takes advantage of a previous MHPG disclosure, that of using the laptop lid for cooling, but does not rely upon it.

**Proposed laptop
cooling system by
pumping fluid**



Current laptop cooling

